

REMARKS

The Examiner provides a number of rejections and we list them here in the order in which they are addressed:

- I. Rejections Under 35 U.S.C. § 102
 - A. Claims 6, 10 and 12 are rejected under 35 U.S.C. § 102(b) as being allegedly anticipated by United States Patent No. 5,376,252 To Ekstrom *et al.*
 - B. Claims 1, 6, 10 and 12-13 are rejected under 35 U.S.C. § 102(e) as being allegedly anticipated by United States Patent No. 5,637,469 To Wilding *et al.*
 - C. Claims 2-5, 7-9, 11, and 13 are rejected under 35 U.S.C. § 102(e) as being allegedly anticipated by United States Patent No. 5,922,591 To Anderson *et al.*
- II. Claims 2-5, 7-9, 11 and 13 are rejected under 35 U.S.C. § 103(a) as being allegedly obvious over United States Patent No. 6,319,469 To Mian *et al.*

I. The Claims Are Not Anticipated

As the Examiner is well aware, a single reference must disclose each limitation of a claim in order for that reference to anticipate the claim. *Atlas Powder Co. v. E.I. du Pont De Nemours & Co.*, 224 U.S.P.Q. 409, 411 (Fed. Cir. 1984). This criterion is not met with any of the three cited references discussed below.

A. Ekstrom *et al.* Does Not Anticipate Claims 6, 10 and 12

The Examiner alleges that Ekstrom *et al.* anticipates the pending claims by "... teach[ing] a microfluidic device including a microchannel made from a glass substrate ... hydrophobic spacer ... and ... a liquid inlet. *Office Action*, pg 2 ¶ 2. The Applicants disagree and respectfully submit that the Examiner has inappropriately relied on a passing mention of a potential hydrophobic interaction of an aqueous solution with the disclosed channels:

The spacing layer (when stabilized) should preferably also have surface properties providing for suitable surface characteristics when joined to a base layer and defining a cavity or channel therewith, e.g., hydrophobic-hydrophobic interaction for applications involving aqueous solutions. *Ekstrom et al.*, col. 4 ln 25-31.

The Applicants argue that this brief mention of hydrophobicity is not an enabling description. Specifically, Ekstrom *et al.* never again mentions a hydrophobic layer existing within or on any channel. Further, there are no claims in Ekstrom *et al.* reciting a hydrophobic layer.

why not?

not claimed

Nonetheless, without acquiescing to the Examiner's argument but to further the prosecution, and hereby expressly reserving the right to prosecute the original (or similar) claims, Applicants have amended Claim 6 (and concomitantly canceled Claims 7 and 9) to recite that a hydrophobic region is positioned between a gas-intake pathway and a gas vent.

Applicants respectfully request the Examiner to withdraw the rejection.

B. Wilding et al. Does Not Anticipate Claims 1, 6, 10 and 12-13

The Examiner alleges that Wilding *et al.* anticipates the pending claims by "... teach[ing] a small scale channel device ... [including] ... a hydrophobic coating. *Office Action*, pg 2 ¶ 3. The Applicants disagree and respectfully submit that the Examiner has inappropriately relied on a passing mention of a potential hydrophobic layer compatible with a contemplated substrate:

A hydrophobic bilayer glycerol monooleate coating may be fabricated on a silicon substrate. *Wilding et al.*, col. 9 ln 30-33.

The Applicants argue that this mention of hydrophobicity is not an enabling description, and in fact is merely a reference to a previous publication. Specifically, Wilding *et al.* never again mentions a hydrophobic bilayer within or on any channel. Further, there are no claims in Wilding *et al.* reciting a hydrophobic layer. Nonetheless, without acquiescing to the Examiner's argument but to further the prosecution, and hereby expressly reserving the right to prosecute the original (or similar) claims, Applicants have amended Claims 1 & 6 (and concomitantly canceled Claims 2 & 4 and 7 & 9) to recite that a hydrophobic region is positioned between a gas-intake pathway and a gas vent.

WHY NOT? SO WHAT?

Applicants respectfully request the Examiner to withdraw the rejection.

C. Anderson et al. Does Not Anticipate Claims 2-5, 7-9, 11 and 13

The Examiner alleges that Anderson *et al.* anticipates the pending claims by "... teach[ing] a microfluidic device ... [having a] ... porous hydrophobic portion ... provided in a channel ...". *Office Action*, pg. 3 ¶ 4. The Applicants disagree and respectfully sumit that the Examiner has misread Anderson *et al.* Applicants explain that Anderson *et al.* does not teach a channel having a hydrophobic region, but instead teaches a vent incorporated into a channel, wherein the vent has a hydrophobic membrane:

The fluid plugs may then be flowed along a channel having a vent disposed therein, **which vent includes a hydrophobic membrane**. *Anderson et al.*, col. 30 ln 19-22.

Clearly, the Examiner must agree with the Applicants that this hydrophobic membrane is not part of the channel.

Further, the Examiner attempts to "create" a gas-intake pathway by concluding that a "Positive pressure may be applied to the inlet (e.g., col 30, lines 43-44) and pressure is exemplified by gas pressure (col. 27, lines 23-24). The Examiner has improperly integrated disparate discussions within Anderson *et al.* regarding the unrelated topics of a "pressure differential fluid transport system" and a "fluid inlet system".

Specifically, the passage relied upon by the Examiner for the above conclusion regarding an "inlet" reads as follows:

Application of a positive pressure to the **fluid inlet**, combined with the selective opening of the elastomeric valve at the **fluid connection** of a selected chamber with the main channel will force the **fluid** into that chamber, expelling air or other gases through the vent port ... *Anderson et al.* col. 30 ln 43 - 48. [emphasis added]

Second, the passage relied upon by the Examiner for the above conclusion regarding "gas pressure" reads as follows:

... a pneumatic manifold configuration for carrying out this pressure differential fluid transport system ... includes a **vacuum source** ... with one or more fluidic resistors ... incorporated within the branch channel. These fluidic resistors result in a transformation of the pressure from the pressure/vacuum source, i.e., a step down of the **gas pressure** or vacuum being applied across the resistance. *Anderson et al.*, col. 27 ln 8 - 24. [emphasis added]

Clearly, the Examiner has not identified a gas-inlet pathway within the disclosure of Anderson *et al.* The first passage teaches a **fluid-inlet** pathway while the second reference teaches a **gas-outlet** pathway leading to a reduction in pressure within the channel. Based upon the claim amendments previously identified (*supra*) the Applicants believe this rejection is moot, and respectfully request the Examiner withdraw the rejection.

II. The Claims Are Not Obvious

The Examiner has rejected Claims 2-5, 7-9, 11 and 13 under 35 U.S.C. § 103(a) as allegedly being obvious over United States Patent No. 6,319,469 To Mian *et al.* The Applicants disagree and, based upon the claim amendments made previously in this Office Action response, explain below that the Examiner has failed to make a *prima facie* case.

To establish a *prima facie* case of obviousness, three basic criteria must be met. First, there must be some suggestion or motivation, either in the reference(s) themselves or in the

knowledge generally available to one of ordinary skill in the art, to modify the reference. Second, there must be a reasonable expectation of success. Finally, the prior art reference (or references when combined) must teach or suggest all the claim limitations. *In re Vaeck*, 947 F.2d 488, 20 USPQ.2d 1438 (Fed. Cir. 1991); and MPEP § 2142; Establishing A *Prima Facie* Case Of Obviousness. The Examiner is reminded that if ONLY ONE of the above requirements is not met, then a *prima facie* case of obviousness does not exist. In the present Office Action, the Applicants clearly demonstrate that the Examiner's rejection does not meet these criterion. The Applicants rebut the establishment of a *prima facie* case of obviousness by the argument below.

The Examiner states that Mian *et al.* teaches "Air inlets, outlets .. to direct the movement of the fluid (col. 8 lines 54-end). *Office Action* pg. 4 ¶ 5 [emphasis added]. The Applicants disagree and respectfully submit that the Examiner has misread the passage in Mian *et al.* The passage relied upon by the Examiner for the above assertion is as follows:

Input and output (entry and exit) ports are components of the microplatforms of the invention that are used for the introduction o[r] removal of a variety of **fluid components**. Entry ports are provided to allow samples and reagents to be placed on or injected onto the disk ... *Mian et al.* col. 8 ln 54- 58. [emphasis added]

The Examiner should note that Mian *et al.* has defined the term fluid; "Fluid (including reagents, samples and **other liquid components**) ... col. 7 ln 25-26. [emphasis added].

Clearly, the Examiner now understands that the inlets taught by Mian *et al.* are limited to liquid entry and do not include gaseous entry.

Further, even if the above inlets did provide gas entry (which they do not), Mian *et al.* does not teach any fluid movement driven by differential gas pressures. Instead, Mian *et al* teaches:

... a micromanipulation device for manipulating the platform to achieve **fluid movement** on the platform arising from centripetal force on the platform as a result of rotation. *Mian et al.* col. 6 ln 34-37. [emphasis added]

Applicants conclude that Mian *et al.* does not: i) provide any motivation or suggestion to utilize gas pressure for fluid movement and ii) teach all the limitations of the pending claims by failing to teach a gas-inlet pathway. Consequently, Applicants respectfully request the Examiner withdraw this rejection.

CONCLUSION

The Applicants believe that the arguments and claim amendments set forth above traverse the Examiner's rejections and, therefore, request that all grounds for rejection be withdrawn for the reasons set above. Should the Examiner believe that a telephone interview would aid in the prosecution of this application, the Applicants encourage the Examiner to call the undersigned collect at 617.252.3353.

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APPENDIX I
MARKED-UP VERSION OF REWRITTEN CLAIMS
PURSUANT TO 37 CFR § 1.121 (c)(1)(ii)

1. (Amended) A device comprising a microdroplet transport channel etched in substrate, said substrate selected from the group consisting of silicon, quartz and glass, said channel comprising one or more hydrophobic regions, wherein said device further comprises a gas-intake pathway in fluidic communication with said microdroplet channel and wherein one of said hydrophobic regions is positioned in said channel between said gas-intake pathway and said gas vent.

6. (Amended) A device comprising a microdroplet transport channel, said channel comprising i) first and second ends, and ii) a hydrophobic region[s] disposed within said channel between said first and second ends, wherein said device further comprises a gas-intake pathway positioned internal to said first end of said channel, said gas-intake pathway in fluidic communication with said microdroplet channel, and further wherein said hydrophobic region is positioned in said channel between said gas-intake pathway and said gas vent.

10. The device of Claim 6, wherein said first end of said channel comprises an inlet port for the introduction of liquid.

APPENDIX II
CLEAN VERSION OF THE ENTIRE SET OF PENDING CLAIMS
PURSUANT TO 37 CFR § 1.121 (c)(3)

1. A device comprising a microdroplet transport channel etched in substrate, said substrate selected from the group consisting of silicon, quartz and glass, said channel comprising one or more hydrophobic regions, wherein said device further comprises a gas-intake pathway in fluidic communication with said microdroplet channel and wherein one of said hydrophobic regions is positioned in said channel between said gas-intake pathway and said gas vent.
3. The device of Claim 1, wherein said device further comprises a gas vent in fluidic communication with said microdroplet channel.
5. The device of Claim 1, further comprising an air chamber in communication with said gas-intake pathway.
6. A device comprising a microdroplet transport channel, said channel comprising i) first and second ends, and ii) a hydrophobic region disposed within said channel between said first and second ends, wherein said device further comprises a gas-intake pathway positioned internal to said first end of said channel, said gas-intake pathway in fluidic communication with said microdroplet channel, and further wherein said hydrophobic region is positioned in said channel between said gas-intake pathway and said gas vent.
8. The device of Claim 6, wherein said device further comprises a gas vent i) positioned internal to said second end of said channel, and ii) in fluidic communication with said microdroplet channel.
10. The device of Claim 6, wherein said first end of said channel comprises an inlet port for the introduction of liquid.

11. The device of Claim 6, further comprising an air chamber in communication with said gas-intake pathway.
12. The device of Claim 6, wherein said device is fabricated from a glass, quartz or silicon substrate.
13. The device of Claim 12, wherein said channels are between 5 and 20 μm in depth and between 20 and 1000 μm in width.